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BULLETIN

of

The Aerial Photography Department in the Field

2306 C.17

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WASHINGTON, *December 7, 1917.*

The following pamphlet, entitled "Bulletin of the Aerial Photography Department in the Field," is published for the information of all concerned.

(062.1, A. G. O.)

BY ORDER OF THE SECRETARY OF WAR:

JOHN BIDDLE,
Major General, Acting Chief of Staff.

OFFICIAL:

H. P. McCAIN,
The Adjutant General.

TABLE OF CONTENTS.

The study of German organizations by means of aerial photography: Page.

Part I.—Saps 7
Generalizations—Plan of trenches, flanking 8
Firing trenches 11
Communication trenches 16
Closed firing trenches 21
Attacking saps 24
Shelters 27
1. Splinter-proof shelters 27
2. Shelters giving protection against direct hits, built from the ground up 29
3. Shelters giving protection against direct hits, built underground 31
4. Covered trenches 32
Auxiliary defenses 36
Machine guns—Trench mortars—Guns 44
1. Machine guns 44
2. Trench mortars 47
3. Guns 52
Appendix I.—First-line defense at Remenauville 53
Appendix II.—Sector of the Third Company, etc 54
Appendix III.—Salient D, etc 55
Appendix IV.—Machine gun, gun, and trench mortar emplacements, etc 57
Part II.—Batteries 58
Chapter I.—Gun emplacements 58
Chapter II.—Normal battery 60
Chapter III.—Buried battery 62
Chapter IV.—Special antiaircraft batteries 63
Chapter V.—Long-range pieces 63
Chapter VI.—Signs of occupation 65
Chapter VII.—Batteries under cover 66

THE STUDY OF GERMAN ORGANIZATIONS BY MEANS OF AERIAL PHOTOGRAPHY.

PART I.—SAPS.

Aerial photography supplies material for two sorts of investigation—technical and tactical.

The aim of technical investigation is the research and thorough analysis of the details of organization—emplacement of machine guns, trench weapons and devices, batteries, observation stations, shelters, obstacles, and auxiliary defenses, etc.

When the means of the adversary's action is known the tactical investigation examines their operation and endeavors to discover the intentions of the enemy. Such investigation is outside the limits of this article and belongs more particularly to the duties of the staff.

Technical investigation, which alone concerns us here, demands a preliminary knowledge of the methods and procedures in use in the German Army.

In this manner the information obtained from German regulations enforced before the war has served as a foundation for the article of September 20 on the use of aerial photography.

The present study is a sequel to that article and follows the plan of it. The new documents which have come into our possession, particularly "Information Drawn from the War Relative to Field Fortification (Translation of the Technical Section of the Engineers)," form the basis. Moreover there has been liberal borrowing from the works of the following lieutenant observers: Couderc, Pepin, Rousselet, Jaulin, and Paulon.

The following article is divided into two parts:

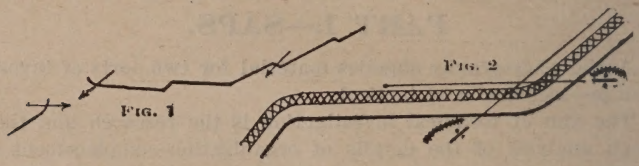
The first treats of the first-line organizations; the second of batteries.

The second part is due entirely to Lieuts. Couderc, Pepin, and Rousselet.

Supplementary investigations coming under the same general category will eventually appear in the Bulletin when new information permits additional precision.

GENERALIZATIONS—PLAN OF TRENCHES, FLANKING.

When the enemy intends to make an obstinate defense he organizes at least two positions, one behind the other. The distance between these two positions should not be less than 1 or 2 kilometers. It may be considerably more if circum-



stances demand. Each position includes several lines connected by numerous communication trenches. These are not continuous right lines.

(*a*) The trenches are formed of broken lines in order to be adapted to the ground as well as possible. (Fig. 1, photos 1 A and 1 B, fig. 2.)

Photo 1 A.

(*b*) Small salients in the firing lines are frequently employed. (Fig. 3 and photo 3.) Then a communication can be formed in the rear of the traverses thus produced.

(*c*) From position the enemy extends ahead carefully constructed trenches, in which flanking detachments are installed. (Fig. 4 and photo 4.)

(*d*) The terrain may show special advanced organizations. Groups of advanced riflemen (Rifle Battery) with communication trench toward the position. (Fig. 5 and photo 5.)

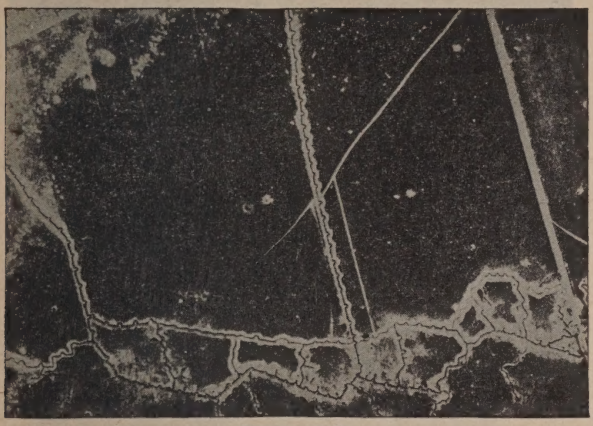


PHOTO 1 B.

(*e*) Sometimes several means of flanking are coordinated; as when the enemy sends groups forward to cover a depression

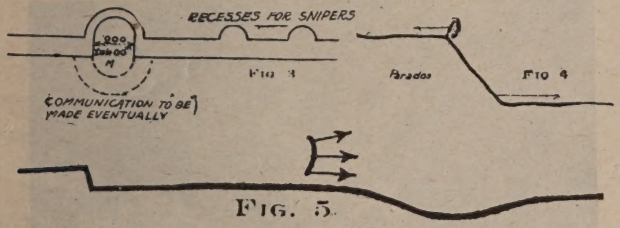


FIG. 5.

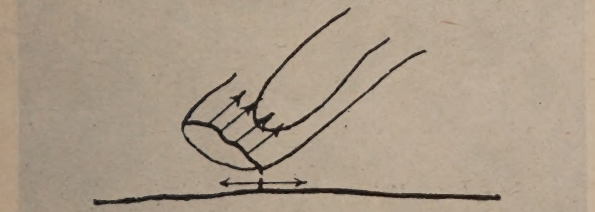


FIG. 6

invisible from the position, it may happen that the avenue of access serves for the flanking of a part of the main front. (Fig. 6.)

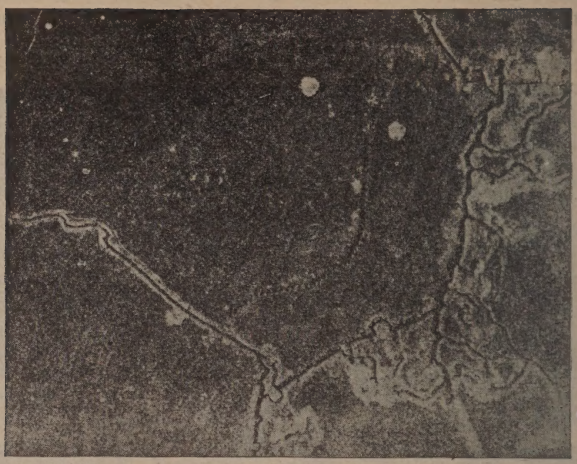


PHOTO 3.

PHOTO 4.

(*f*) Sometimes, particularly in a wood, the enemy adopts a tenailled trace. (Fig. 7.)

PHOTO 5.

FIRING TRENCHES.

The necessity of being protected against flank fire results in doing away with long trenches laid out in a right line, and in establishing trenches with traverses. (Fig. 8.)

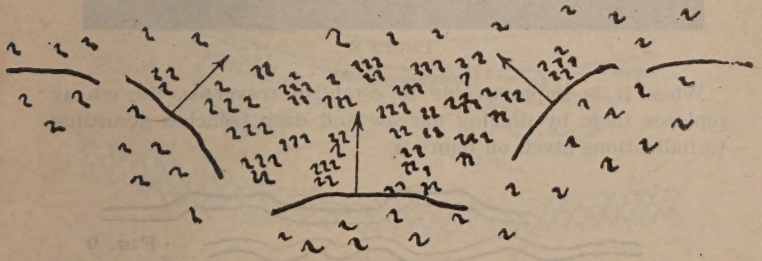


FIG. 7

The width of the top of the traverses varies from 2 to 4 meters.

In exposed places their spacing can be reduced to 4 or 5 meters. Traverses often assume a rectangular form and give

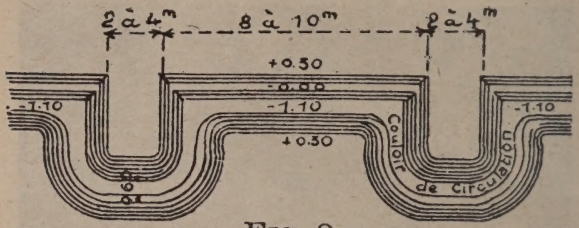


FIG. 8

the whole trench system the appearance of a fretwork. (Photo 8.)

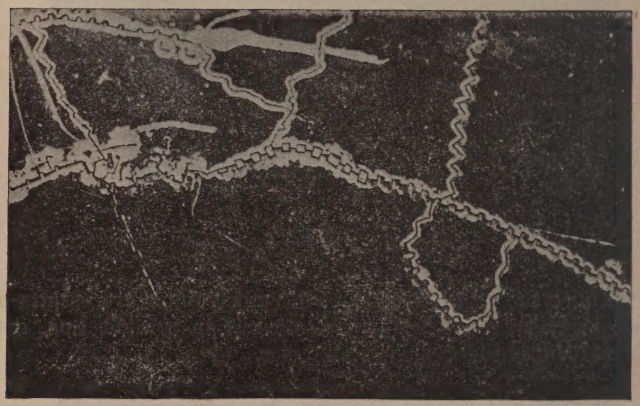


PHOTO 8.

When it is impracticable to establish traverses, the enemy replaces them by digging narrow and deep trenches according to indications given on figure 9.

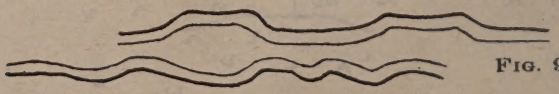


FIG. 9

In places particularly exposed to flank fire the special recesses for snipers are organized between the traverses. (Fig. 10 and photo 10.)

These recesses are often found in old trenches which have suffered from vicissitudes of the weather.

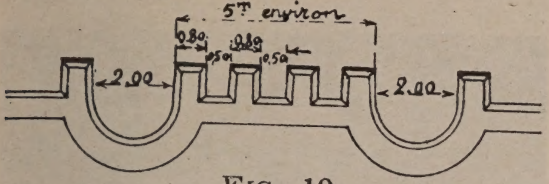


FIG. 10

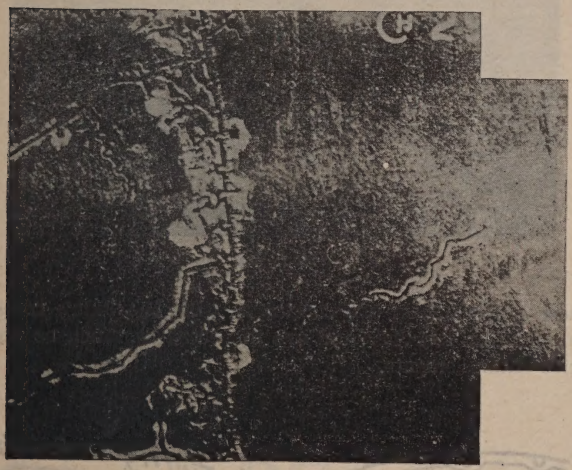


PHOTO 10.

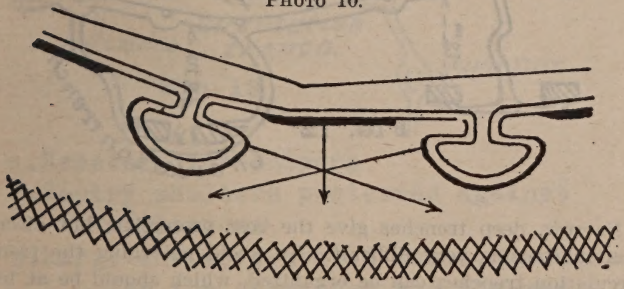


FIG. 11

Small positions are frequently found placed in front of the enemy trenches, or at least snipers' pits, to keep the auxiliary

defenses under surveillance and to keep at a distance our observers and our marksmen. (Fig. 11 and photo 11.)

PHOTO 11.

These snipers' pits are connected with the firing trench by communication trenches and are protected as much as possible by wire entanglements.

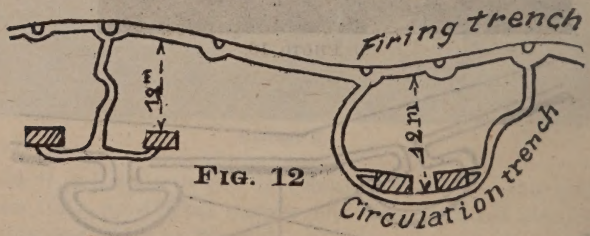


FIG. 12

Narrow, deep trenches give the best protection, but circulation in them is very difficult. To avoid enlarging the trench, circulation trenches can be organized, which should be at least 12 meters distant from the firing trench. (Figs. 12 and 13 and photos 12 and 13.)

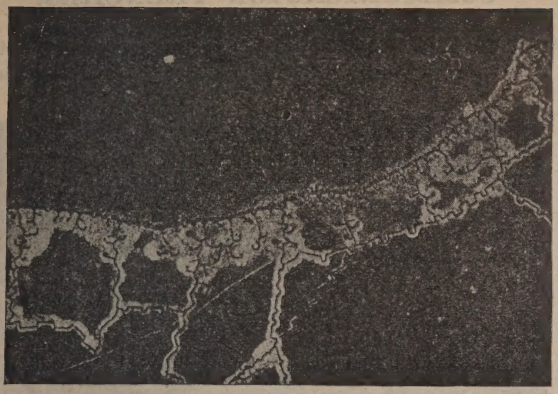


PHOTO 12.

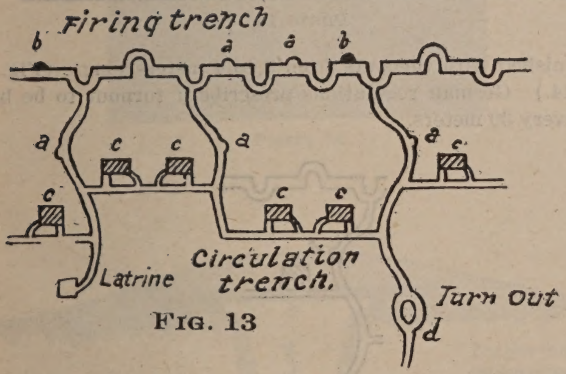


FIG. 13

a. Recesses for snipers
b. Sentry shelters protected against explosions
c. Large shelters (heated rooms, quarters for the commander and the men, dressing station).
d. Communication trench.

COMMUNICATION TRENCHES.

Communication trenches have a roofing-protected height of from 2 to 2.5 meters. When they have a narrow profile, they

PHOTO 13.

are furnished with turnouts from 3 to 4 meters long. (Fig. 14, photo 14.) German regulations prescribe a turnout to be built about every 30 meters.

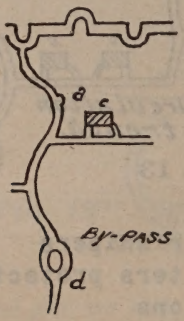


FIG. 14

On slopes facing our lines, to avoid enfilade fire, communication trenches are built in serpentine form, in tenailled lines composed of short elements, or of serpentine saps. (Photo 15.)

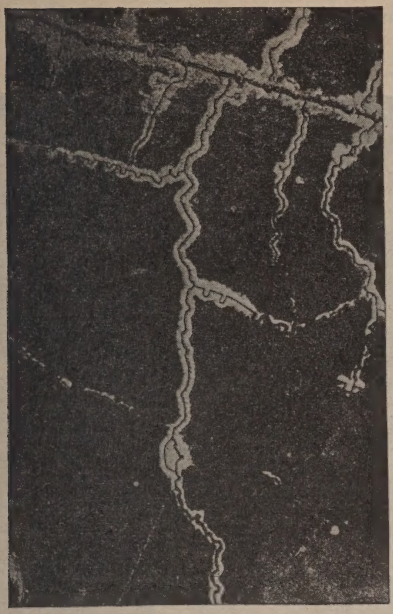


PHOTO 14.

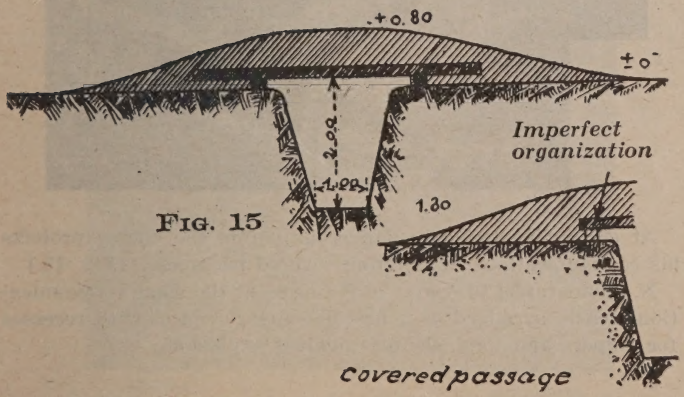


FIG. 15

In case the terrain makes it necessary to advance in a straight line, the communication trenches are furnished with traverses. (Photo 15.)

Photo 15.

At certain particularly dangerous points the enemy protects his communications by building covered passages. (Fig. 15.)

N. photographs 16 A and 16 B represent the same communication trench, arranged as a first-line firing trench, with recesses for snipers and light shelters against explosions.

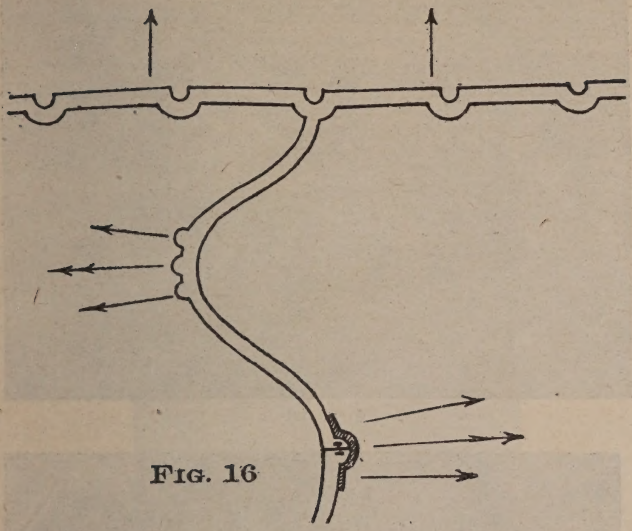


FIG. 16

Médius. Annulaire.

PHOTO 16 A.

Photo 16 B.

Photo 16 C.

Often emplacements for firing are built in the communication trenches most easily by cutting recesses for snipers in them. (Fig. 16, photos 16 A, 16 B, and 16 D.) According to circumstances a machine gun can be mounted here. (Fig. 16, photos 16 C and 16 D.)

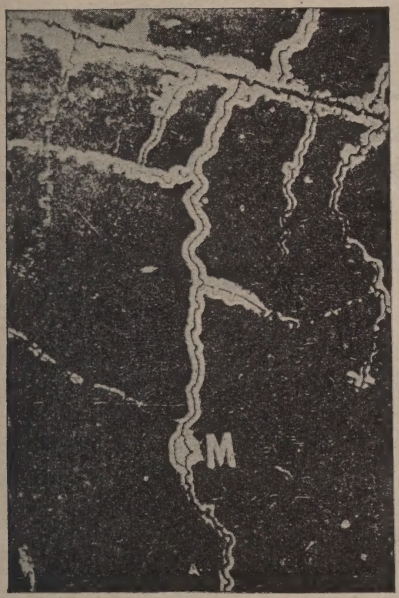


PHOTO 16 D.

CLOSED FIRING TRENCHES.

The enemy often fortifies sheltered bits of ground, parts of forests, villages with streets, houses, etc., to the rear of the front line in order to use them as supporting points. Likewise in default of suitable emplacements closed firing trenches can be organized when circumstances demand. By means of communication trenches circulation is secured between the forward and rear portions of closed trenches, and with the exterior. (Fig. 17 and photos 17 A, 17 B, 17 C, 17 D, and 17 E.)

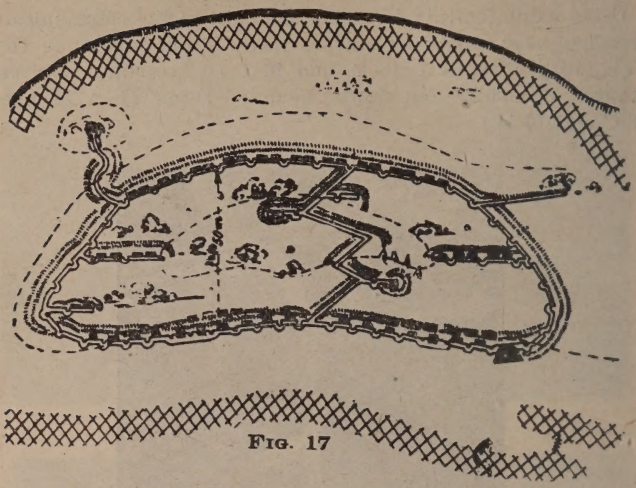


FIG. 17

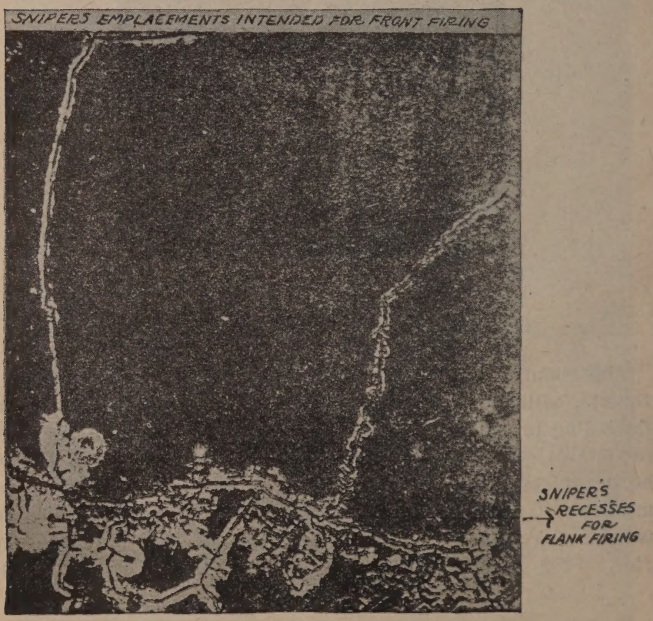


PHOTO 17.

ATTACKING SAP.

Snipers' emplacements intended for front firing.

PHOTO 17 B.

PHOTO 17 A.

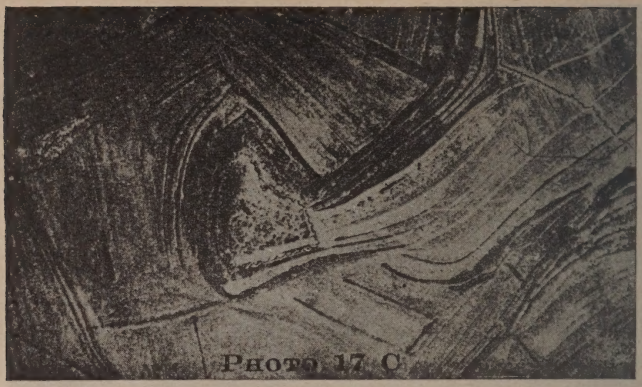


PHOTO 17 C.

ATTACKING SAPS.

Attacking saps are trenches which are extended forward, the men always working under cover. In order to fire ahead and

PHOTO 17 D.

PHOTO 17 E.

protect the men at work, there are here and there at their head, emplacements for snipers (photo. 17) or laterally jutting recesses to give flank fire (photo. 17). Certain parts of the sap likewise can be organized into firing trenches.

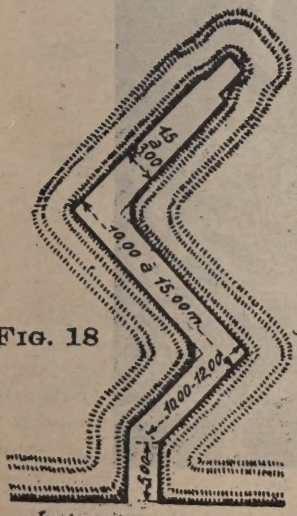


FIG. 18

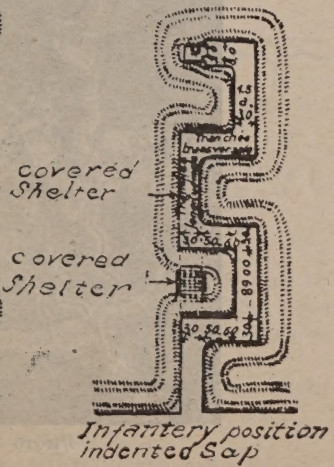


FIG. 19

There are various kinds of saps—serpentine saps (fig. 18), curved saps, indented saps (fig. 19).

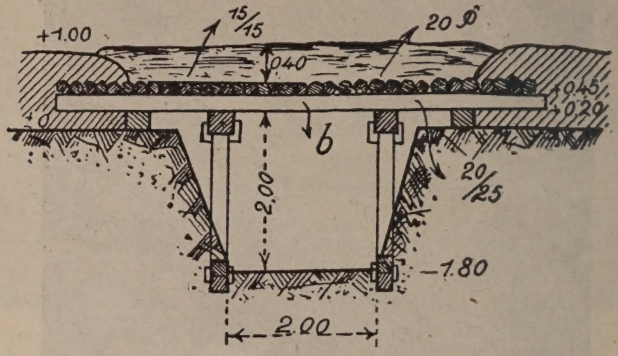


FIG. 20

The curved sap is the most used. The enemy often shelters certain parts of the sap in a special manner to protect it against

PHOTO 20.

hand grenades, and the fire of light bomb throwers. (Fig. 20 and photo 20.)

SHELTERS.

They include mainly:

1. Splinter-proof shelters.
2. Shelters giving protection against direct hits, built from the ground up.
3. Shelters giving protection against direct hits, built underground.
4. Covered trenches.

1. SPLINTER-PROOF SHELTERS.

To reduce as much as possible the effect of direct hits, the enemy prefers numerous small shelters to a limited number of large shelters.

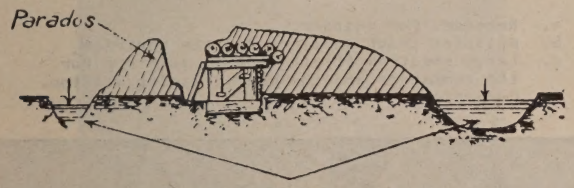


FIG. 21

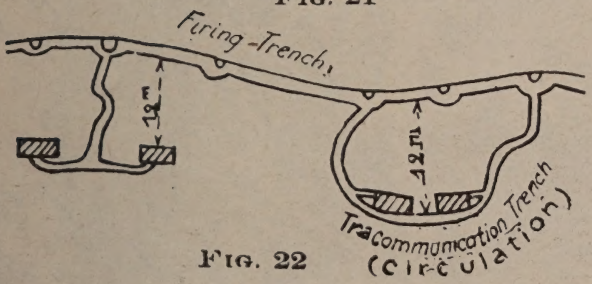


FIG. 22

Light shelters are generally dug rather deep, so that if they are covered with a double layer of roofing beams, breaking joints, and a meter of earth, they will not extend above the parapet to any noticeable degree.

If, owing to the existence of subterranean water a slight distance from the surface, it is impossible to dig deeply, light shelters are built according to figure 21.

It is almost impossible to ascertain the existence of such shelters by aerial photography, the abnormal amount of rubbish

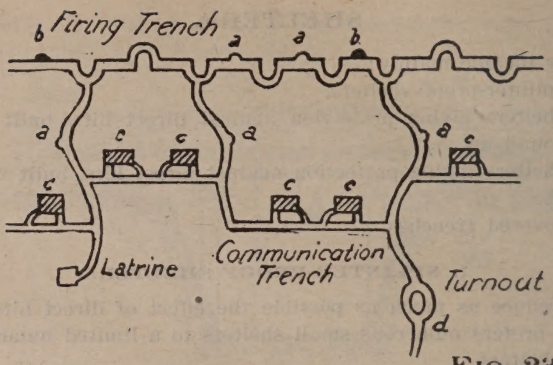


FIG. 23

a. Recesses for snipers.
b. Splinter proof shelters for the sentries.
c. Large shelters (heated rooms, quarters for the commander and the men, dressing station.
d. Communication trench.

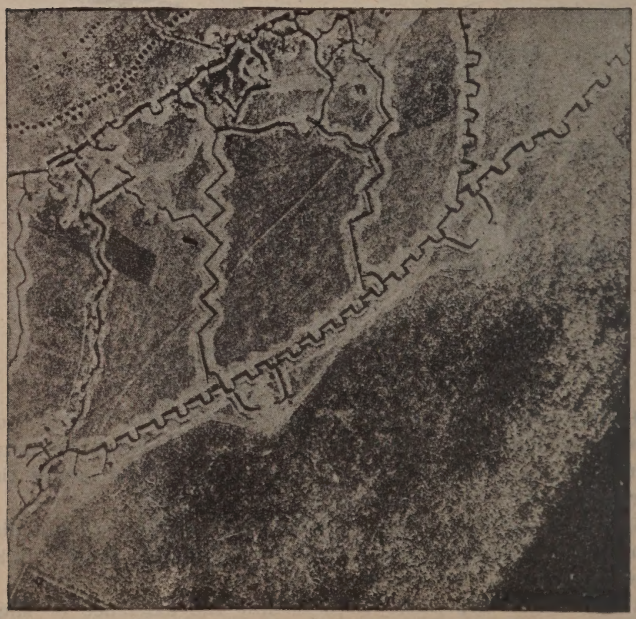


PHOTO 23.

in front of the firing trench being for the most part the only indication susceptible of disclosing them.

2. SHELTERS GIVING PROTECTION AGAINST DIRECT HITS, BUILT FROM THE GROUND UP.

As a protection against direct hits, coming most of the time from the heavy artillery, the enemy builds solid shelters, either in the firing trench itself or in a communication trench at least

PHOTO 23 B.

12 meters to the rear or in covered trenches. (Figs. 22 and 23, photo 23.)

The arrangement of figure 23 is better, for two roads lead to the position.

The examination of aerial pictures representing the same region and taken at different times, enable the history of these shelters to be studied and the different phases of their construction to be followed. (Photo 23 B.)

PHOTO 25 A.

PHOTO 25 B.—Communication trench (circulation) represented on photo 25 A.

3. SHELTERS GIVING PROTECTION AGAINST DIRECT HITS, BUILT UNDERGROUND.

Works in cave or cavern form constructed according to figures 24, 25, 26, 27, 28 (photos 25 A, 25 B) are an excellent protection against direct hits of heavy caliber shells.

The enemy, however, prefers double entrances, as in figure 28.

These shelters are accessible by means of steps at the bottom of the firing trench, or, better, at the bottom of a circulation

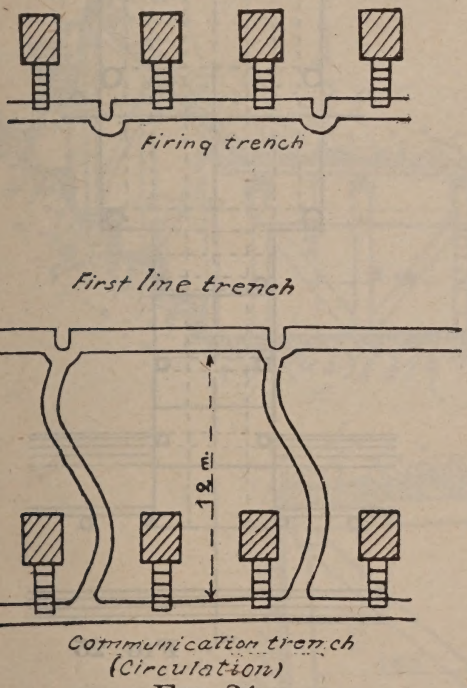


FIG. 24

trench located at least 12 or 15 meters to the rear, and can shelter almost half a battery.

It is generally impossible to discern shelters of this sort on the pictures.

The shelters often take the form of subterranean galleries, and thus produce all the communication systems which escape aerial observation.

Photographs 25 A and 25 B are a striking example of this.

The entrance to the shelters, visible on the photograph taken on the ground, is in no way discernible on the photograph taken from an airplane.

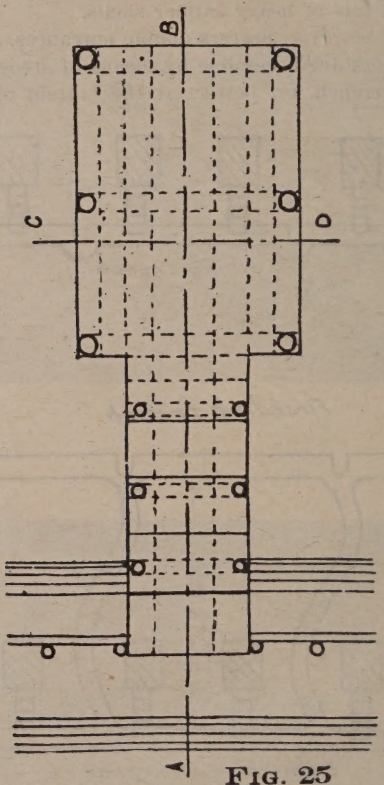


FIG. 25

4. COVERED TRENCHES.

Behind the main line of works the enemy often installs covered trenches used by those portions of the garrison which can not find protection in the first-line shelters in case of heavy bombardment.

These trenches are generally placed behind the zone of dispersion, behind the zone of direct hits aimed at the firing trench, consequently over 50 meters.

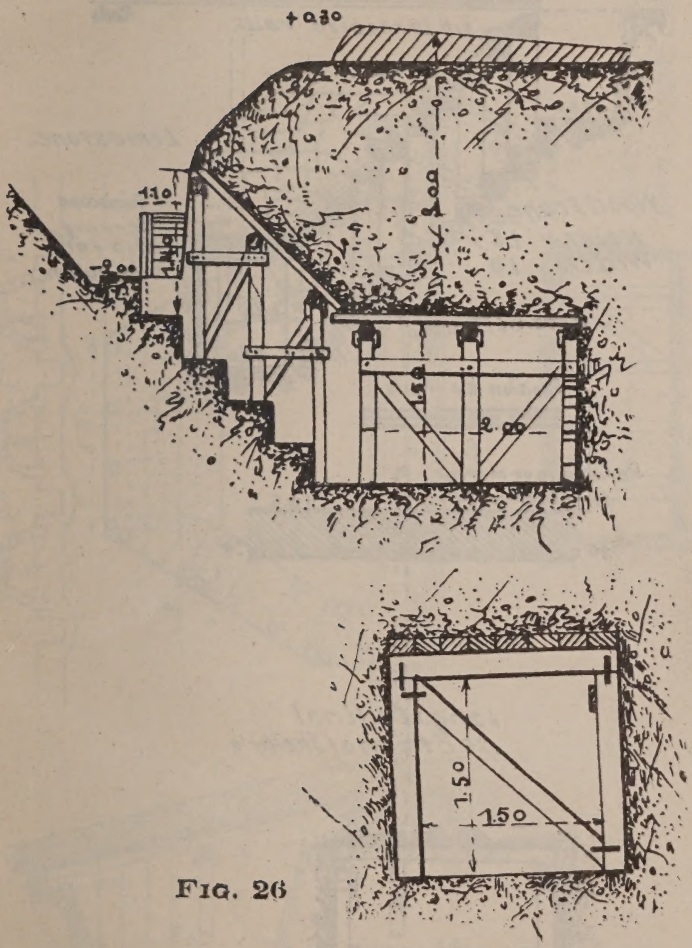


FIG. 26

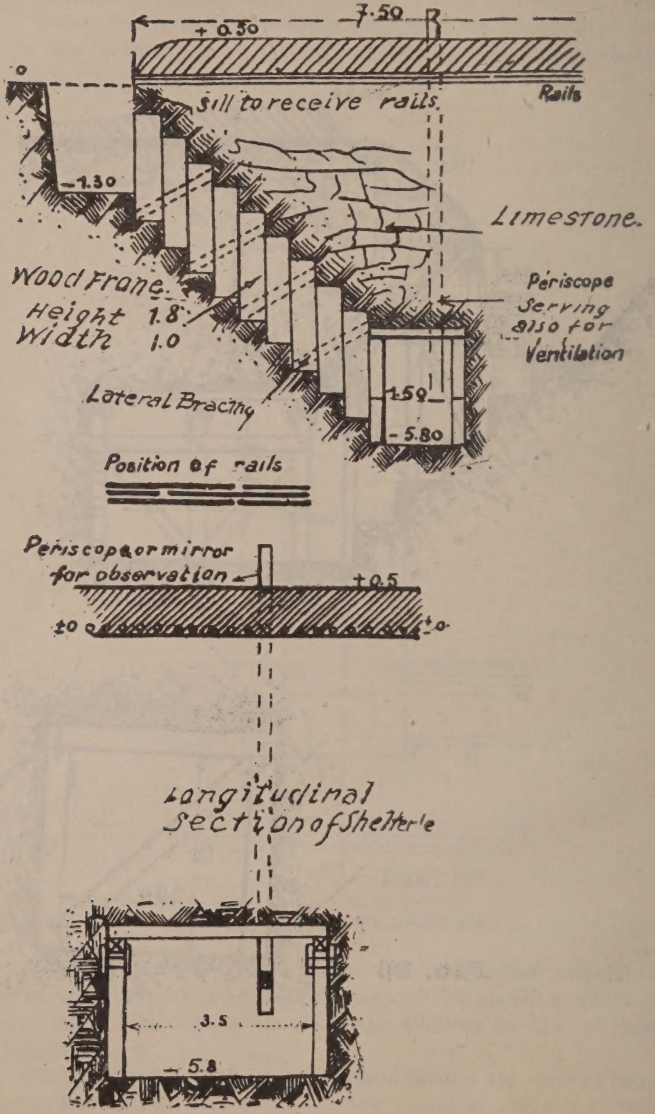

+ 0.30
7.50
Rails
Sill to receive rails.
1.30
Limestone.
Wood Frame.
Height 1.8
Width 1.0
Periscope serving also for Ventilation
Lateral Bracing
1.50
5.80
Position of rails
Periscope or mirror for observation
+ 0.5
± 0
± 0
Longitudinal Section of Shelter
3.5
5.8

FIG. 27

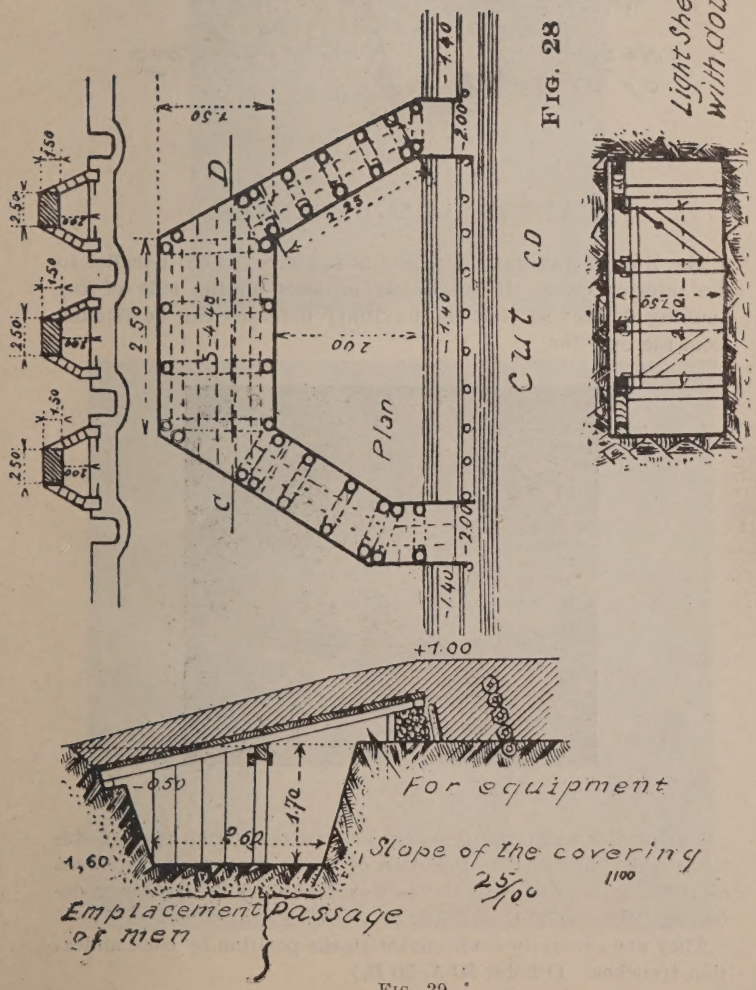

Light shelter (box hore with double entrance
2.50
1.50
D
2.25
2.00
2.50
3.40
C
Plan
Cut CD
+7.00
+6.00
+4.70
+7.00
-0.50
1.70
2.60
1,60
For equipment
Slope of the covering
25/100
1/100
Emplacement of men
passage

FIG. 28

FIG. 29.

Numerous communication trenches connect them with the firing trench. (Figs. 29 and 29 bis.)

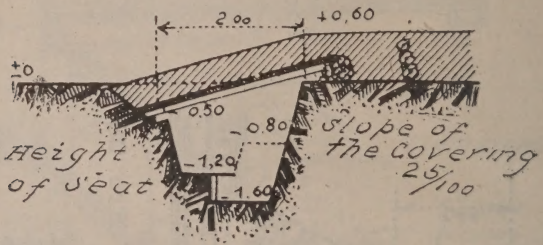


FIG. 29 bis.

AUXILIARY DEFENSES.

The line of auxiliary defenses is not everywhere parallel to the interior crest. It frequently projects on the side of the flanking devices so that the auxiliary defenses can be flanked from the exterior.

PHOTO 30.

During the night the defenses are watched from special stations which are dug at the edge of these defenses or in front of them, and which are themselves protected by auxiliary defenses. (Photo. 30.)

They are generally connected with the position by communication trenches. (Photos 30 A, 30 B.)

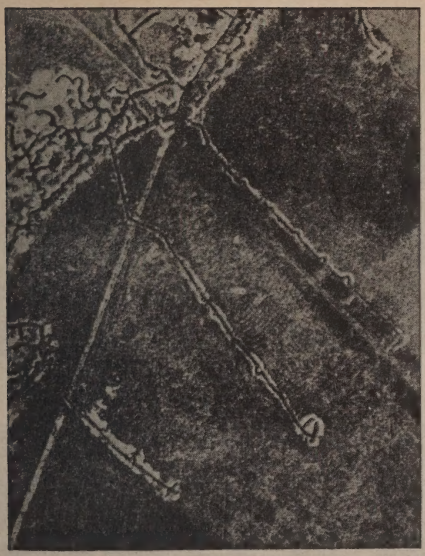


Photo 30 A.

Photo 30 B.

PHOTO 31.

PHOTO 31 BIS.

PHOTO 32.

Photographs 31 and 31 bis, 32 and 32 bis represent the same entanglements photographed from the ground and from an airplane.

The most frequently used auxiliary defenses are wire entanglements.

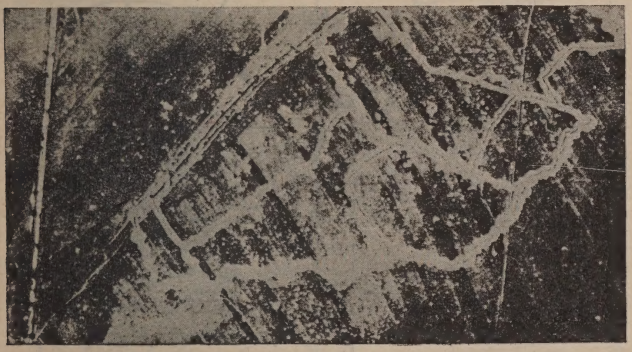


PHOTO 32 BIS.

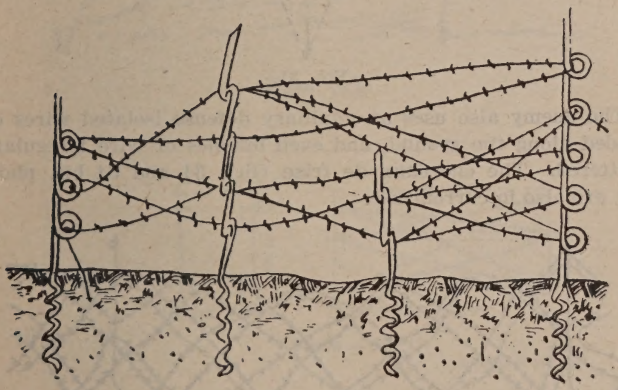


FIG. 30

The wire entanglements are often placed in two or three bands, each one from 6 to 10 meters thick and with an equal interval between them to limit the effects of hostile artillery and all other demolition works. Openings are left free for the

defensive and the passage of sentinels (photo 33 A); these holes are often made en chicane.

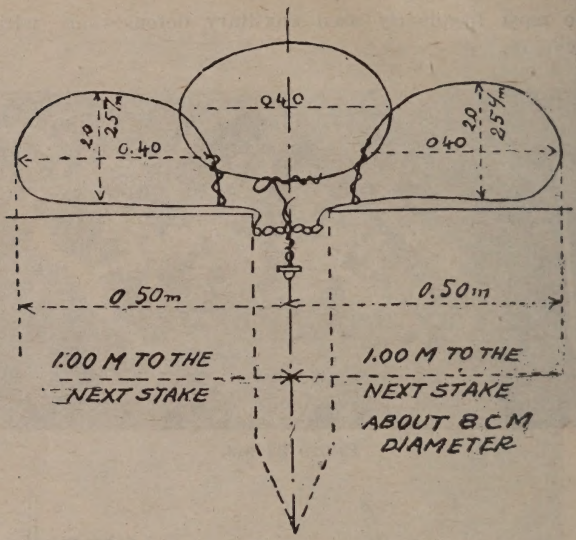


FIG. 31.

The enemy also uses as auxiliary defense isolated wires extended along the ground, and even bundles of wire irregularly scattered. The cheveaux de frise (figs. 34 and 34 bis, photo 34) are also in current use.

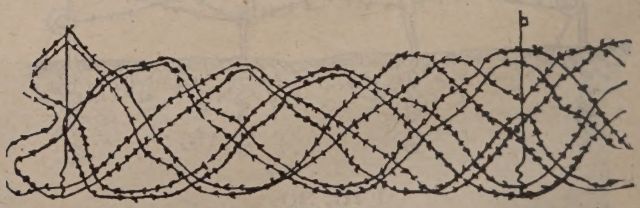


FIG. 32.

There are metal cheveaux de frise and wooden cheveaux de frise. They can even be made in the trenches. Abatis of trees, branches, and trous de loup are likewise used.

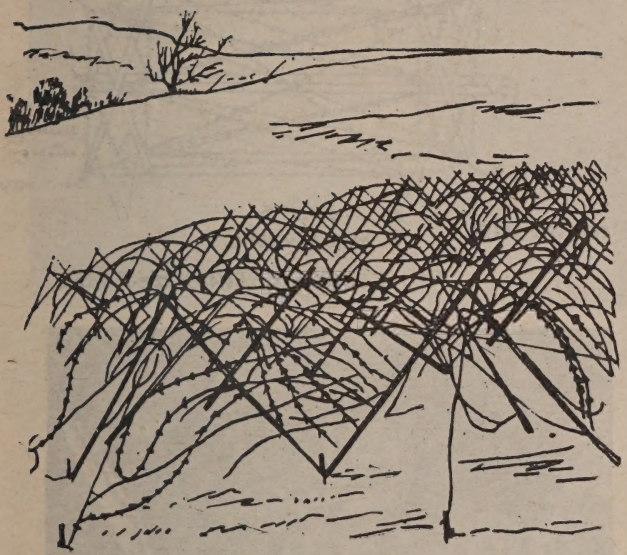


FIG. 33

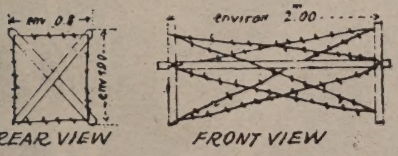
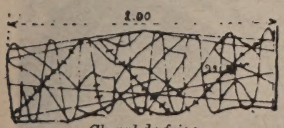
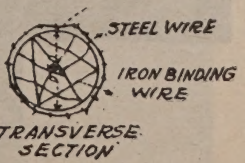


FIG. 34

Chevaux de frise



Cheval de frise



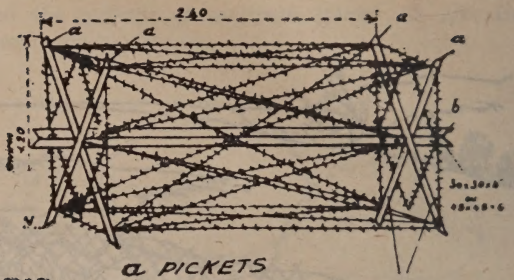


FIG. 34 BIS

a PICKETS
b MEDIAN BAR

TWO LEGGED CHEVAUX-de-FRISE

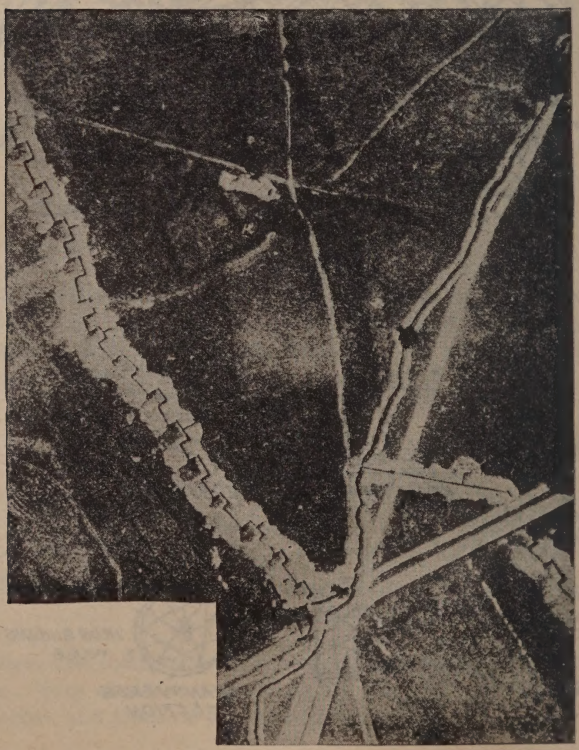


PHOTO 33 A.

PHOTO 34.

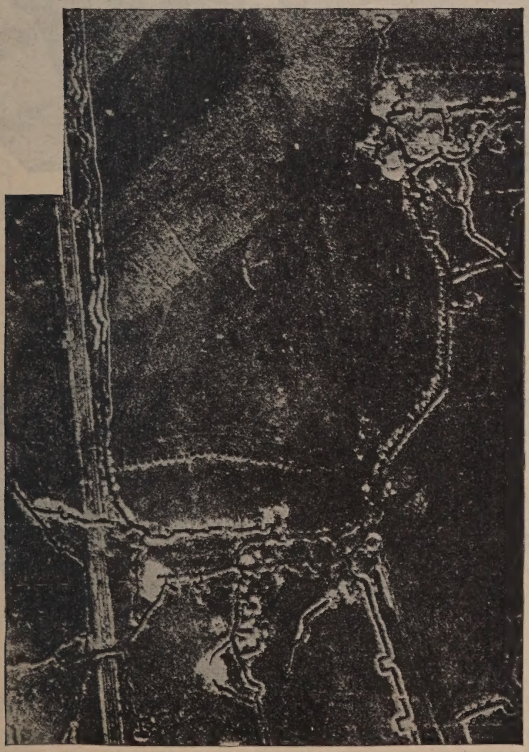


PHOTO 34 BIS.

MACHINE GUNS—TRENCH MORTARS—GUNS.

1. MACHINE GUNS.

Machine guns mounted outside of the trenches are mounted in shelters like those represented in photograph 35.

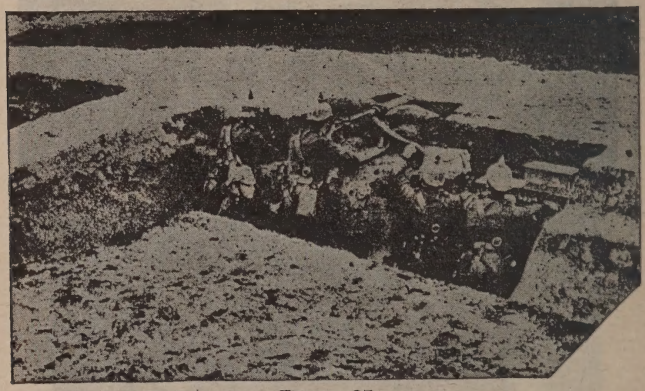


PHOTO 35.

PHOTO 35 A.

Photograph 35 A shows their appearance on aerial photographs.

Sketch 35 B gives the plan of organization of machine guns mounted outside the trenches.

R. J. R. 69.
Machine-gun sketch 35 B.

For frontal fire machine guns are very difficult to cover from sight and shot. For this reason the German regulation does

FIG. 35

not advise shelters to be procured for them, but rather several emplacements under the open sky to be organized, covered only on the front and well screened. As compensation it is easier

to arrange machine guns for flanking auxiliary defenses and lines so that they are intact at the time of close attack.

For this purpose the enemy uses short flanking positions curved to the rear, figure 35.

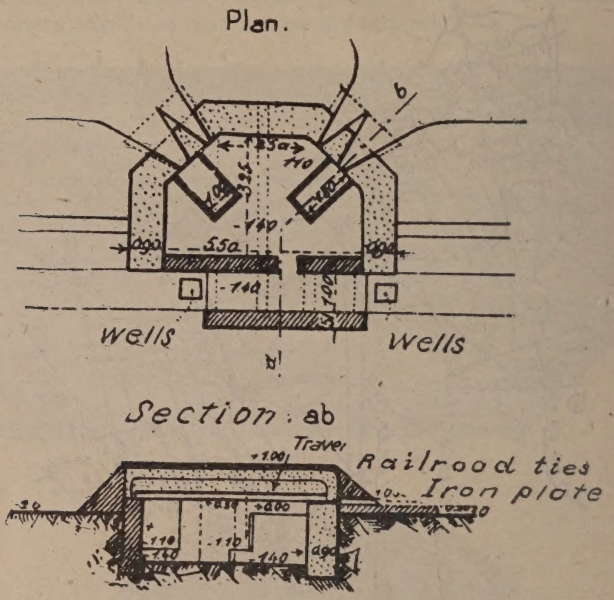


FIG. 36

Concrete firing emplacement for 2 machine guns with resting quarters for assistants.

The enemy also makes use of concrete emplacements constructed according to indications given in figure 36. (Photos 36 A and 36 B.)

The overhead cover, constructed according to indications given on figure 37, permits machine guns placed at the front to be hidden from view in a fairly satisfactory manner.

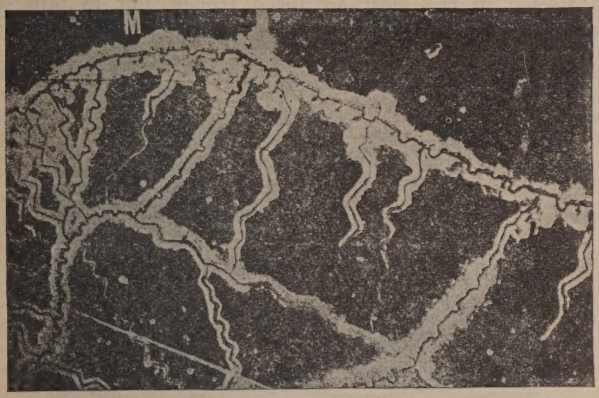


PHOTO 36 A.

PHOTO 36 B.

2. TRENCH MORTARS.

Photographs 37 A, 37 B, 37 C are excellent examples of the arrangement of trench mortars conforming with the plan of figure 37 A.

Emergency trench mortars, because of their short range, can be mounted in first-line trenches by taking precautions, of course, to separate them from each other.

Emplacements for heavy and medium trench mortars are not selected in the most advanced trench, but in blind-alley trenches connected to the communication trenches.

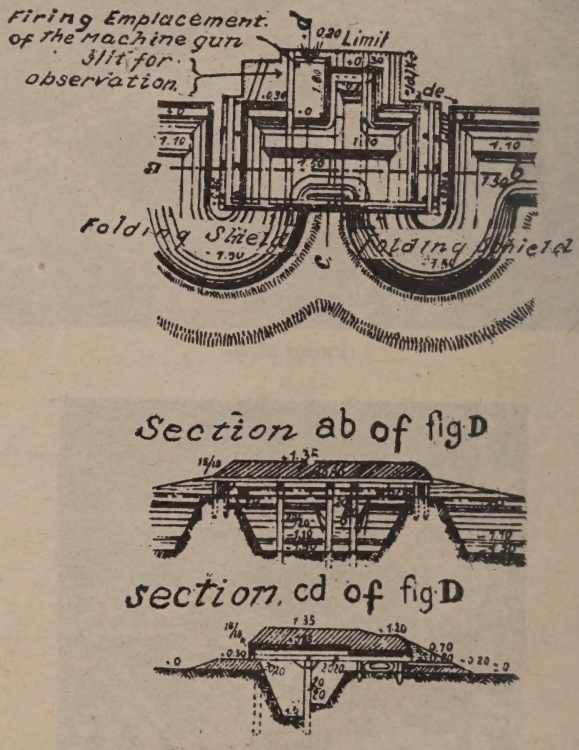


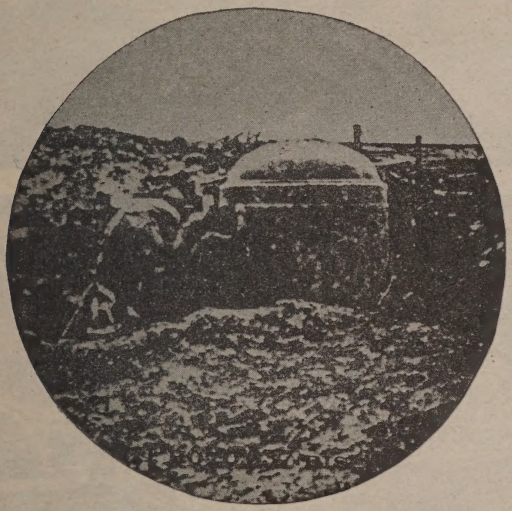
FIG. 37

For protection the enemy covers them with roofs easily removed when the time comes for firing, or a more solid top with a roof proper.

The same thing applies to light trench mortars. If their entire firing range is not to be used, they can be mounted a certain distance behind the heavy and medium trench mortars.

Trench mortars can be easily laid, and each one of them has at least two emplacements prepared in advance.

There are at least two observation stations per piece. Observation of lateral error is made at a point situated on the firing line in front of or to the rear of the trench mortars, while that for error in range demands a lateral observation station as far front as possible.



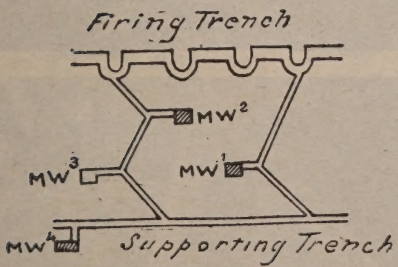


FIG. 37 A

Photo 37 A.

Photo 37 B.

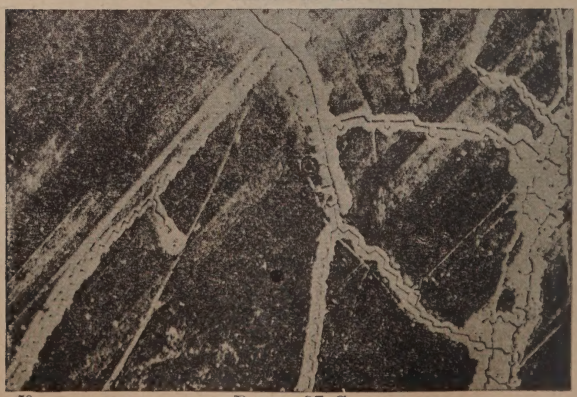


Photo 37 C.

PHOTO 37 TER.

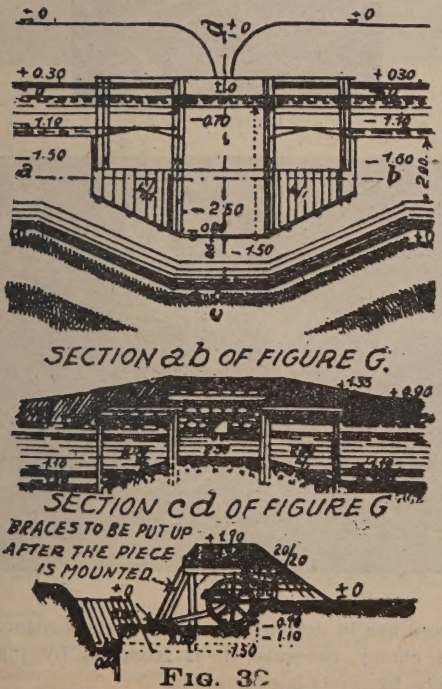


FIG. 3C

3. GUNS.

All light pieces are used for close defense—3, 7, and 5 cm. guns, a part of the 9 cm. field artillery guns. (Photos 37 bis and 37 ter.)

PHOTO 38 A.

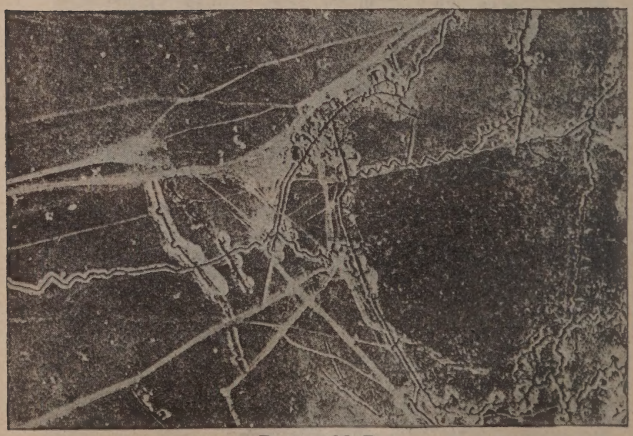
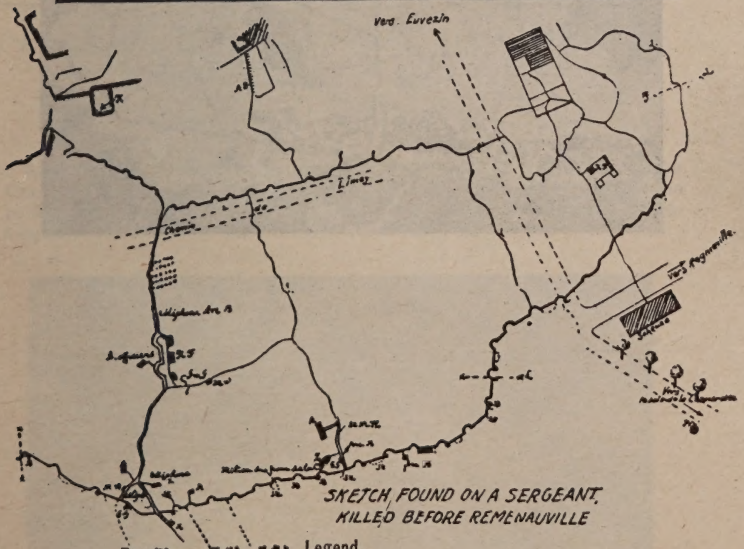


PHOTO 38 B.

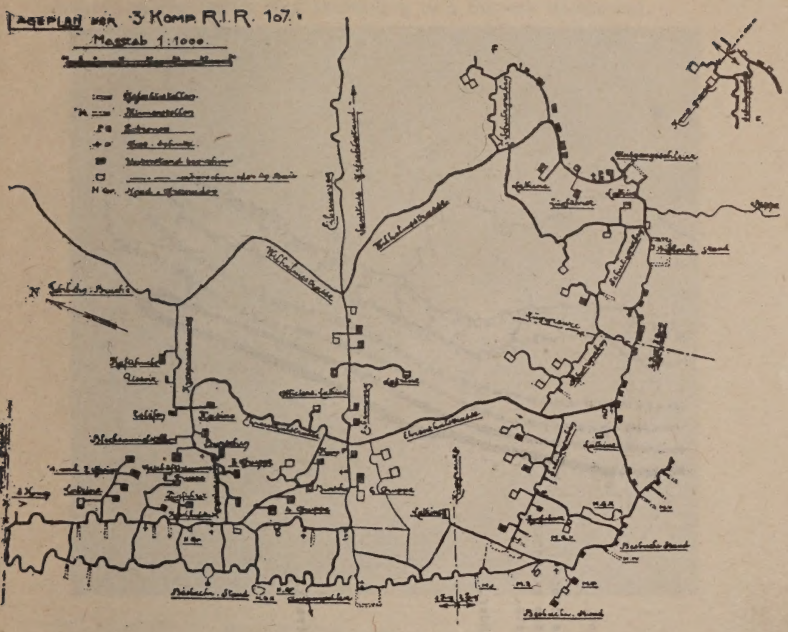
These pieces are in action only against close attacks. Consequently the enemy conceals them from us by placing them under shelters, by screening them, etc.

Figure 38 is an example of emplacement with loopholes for a fieldpiece in an infantry position as far as possible for flanking action (with iron roofing). (See photo 38.)

APPENDIX I.—First-line defense at Remenauville.



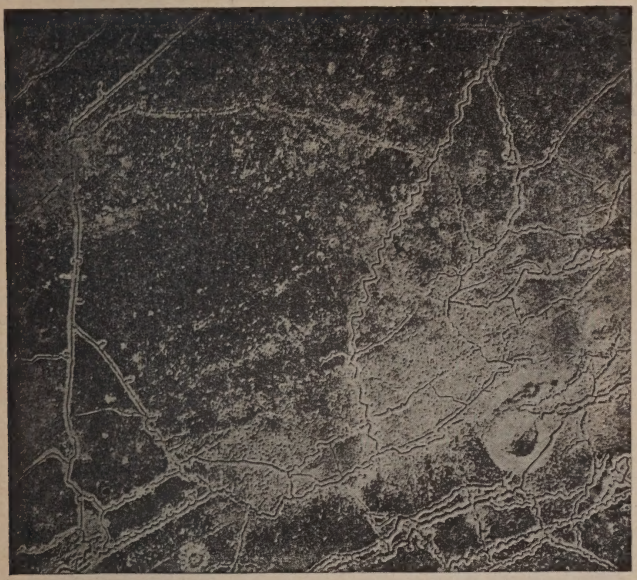
APPENDIX II.—Sector of the Third Company of the One Hundred and Seventh Reserve Infantry Regiment. Example of the organization of a salient, "Salient E."

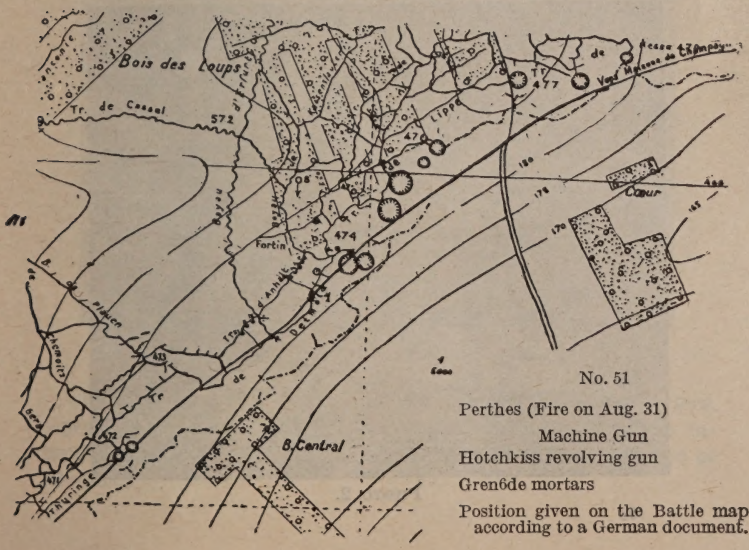


APPENDIX III.—Salient D, sector of the Twelfth Company of the One Hundred and Fourth Reserve Infantry Regiment. Plan of the salient D reconstructed and interpreted according to German documents.

Legend.
Firing trench
Trench, or communication trench, or sheltered trench.
Trench or trace trench.
Firing loophole in first-line trench.
Bomb proof shelter of which the entrance (-)is visible on the photo.
Captain's shelter.
Shelter of the platoon commander.
Gallery shelter.
Light shelter
Telephone.
Latrines.
Chevaux de frise.
Wire entanglements.
Passage through the wire.
Sound station.
Chemin de fond (Present).
Old chemin de rons or other track.
Observation station.
Sentry post.
Gun under shelter.

APPENDIX IV.—Machine gun, gun, and trench mortar emplacements situated on the Battle Map (according to a German document).





No. 51

Perthes (Fire on Aug. 31)

Machine Gun

Hotchkiss revolving gun

Gren6de mortars

Position given on the Battle map according to a German document.

PART II. BATTERIES.

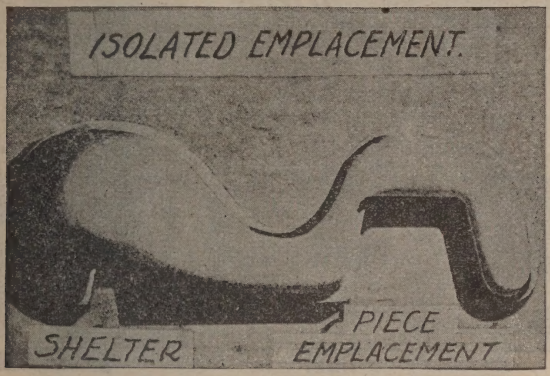
Chapter I.—GUN EMPLACEMENTS.

The gun emplacements are generally arranged in groups of four or six in line. They are *uncovered* and most often appear empty. (See Ch. VI, photo 1, region of Rheims.)

PHOTO 1.

PHOTO 2.

The enemy sometimes adopts a fan-shaped arrangement. (Photo 2, region of Roye.)



Sketch A.

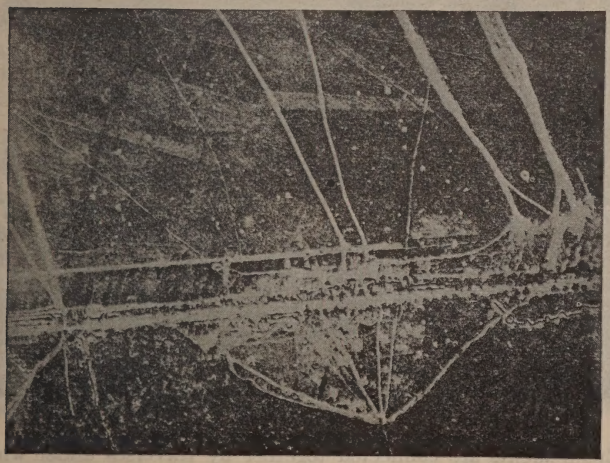
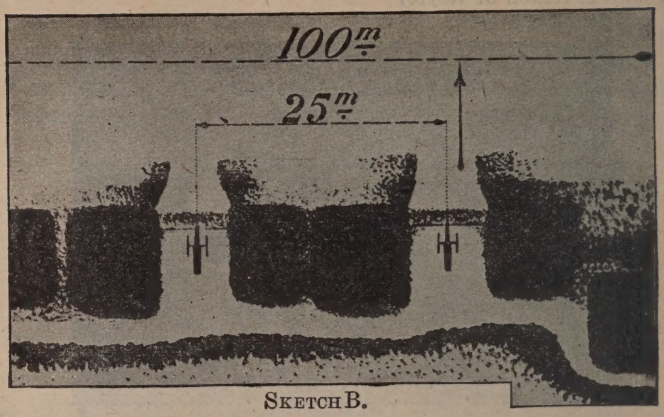


Photo 3.

The emplacements are frequently accompanied by shelters, especially in the case of isolated emplacements which are intended to hold curved fire pieces. (Sketch A, photo 3, region of Rheims.)

Chapter II.—NORMAL BATTERY.



SKETCH B.

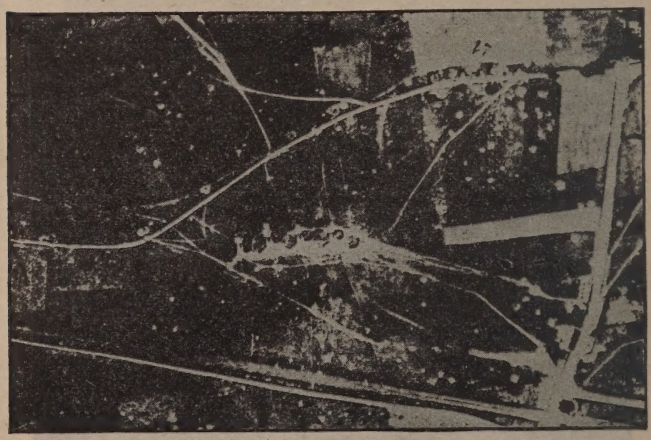


PHOTO 4.

Epaulements are connected together by traverses under which shelters are prepared. Sketch B, photo 4 (region of Arras).

This organization is usually improved upon.

The enemy protects or masks his guns by constructing casemated or camouflaged batteries which present the aspect of an earthwork or a long hedge.

Photo 5 (region of Rheims). Photo 6 (region of Souain).

From A to B, group of batteries masked by a sham wood.

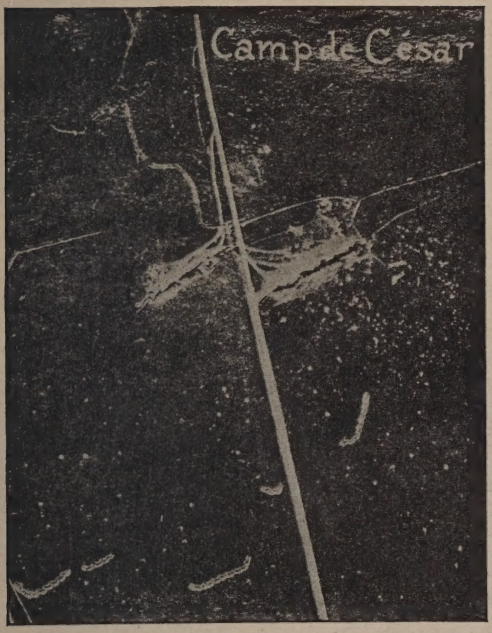


PHOTO 5.

PHOTO 6.

Near the first lines the enemy places his pieces in rectangular ditches supplied by means of a circulation trench. (Sketch C, photo 8, region of Rheims.[1])

[1] This battery was occupied 3 days after the photograph was taken.

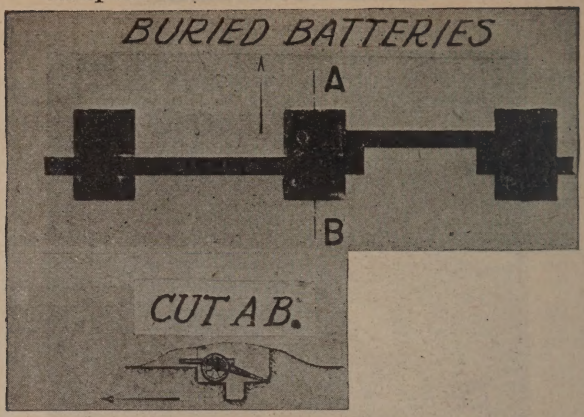
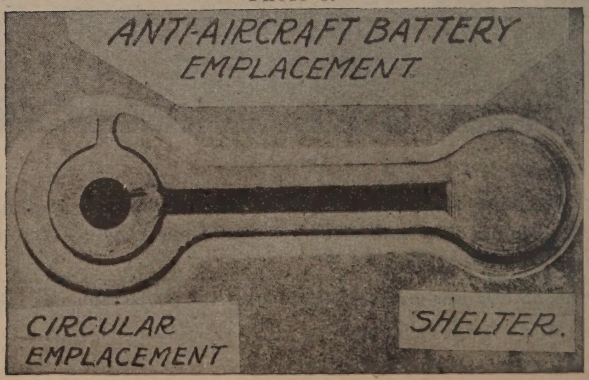


PHOTO 8.



SKETCH D.

Chapter IV.—SPECIAL ANTIAIRCRAFT BATTERIES.

Special antiaircraft batteries are mounted on circular platforms protected by a slope.

Their aspect in plan is that of sketch D, photo 9 (region of Rheims).

PHOTO 9.

Chapter V.—LONG-RANGE PIECES.

PHOTO 10.

The enemy sometimes mounts isolated long-range pieces which are recognized by the importance of defensive works and approaches.

These pieces seem to be mounted on a concrete platform protected by a shield, surrounded by shelters, and always supplied through several ordinary approaches.

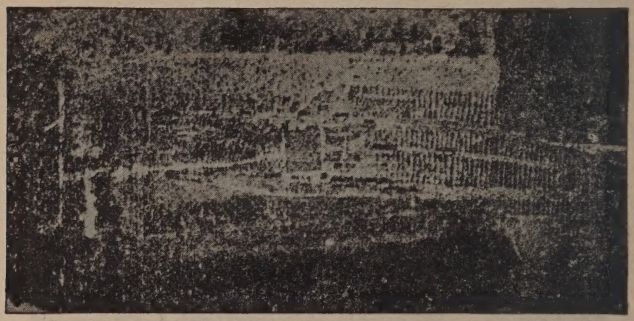


PHOTO 11 A.

PHOTO 11 B.

PHOTO 11 C.

Photo 10 (region of Dixmude, Clerken sheet).

Photo 11 (Mourvilliers region). The photograph shows the large piece which bombarded Chalons at different times while in use.

Chapter VI.—SIGNS OF OCCUPATION.

The examination of a photograph alone does not give absolute proof that a battery is occupied. The ordinary channels of information are used in addition (observations from the ground or the air, locating by sound, information obtained from prisoners).

PHOTO 12.

Photographs can supply the following information:

1. *Tracks.*—Tracks are visible near the emplacements; their abundance and freshness are indications of the possible occupation of the battery. (Photo. 4.)

The total absence of tracks near the emplacements like those described in Chapter I proves absolutely that they are unoccupied. (Photo. 1.)

2. *Railway tracks.*—The enemy often establishes a straight path to supply the ammunition depots and sometimes even the batteries. (Photo. 3.)

3. *Telephone lines.*—In the first line when the network of telephone wires is not installed inside the communication trenches they are buried in small rectilinear and covered drain pipes. (Photo. 12, region of Rheims.)

4. *Erosions.*—The blast of the guns, particularly those which keep up a steady fire, form erosions near their muzzles which appear on the photographs by a whitish line easily visible. (Photo 4.)

Chapter VII.—BATTERIES UNDER COVER.

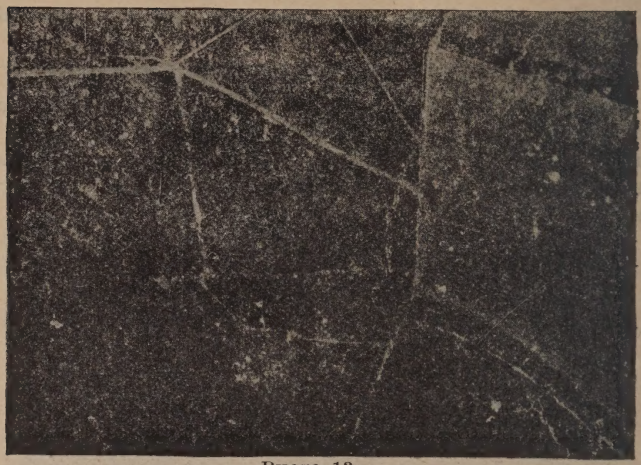


PHOTO 13.

PHOTO 14.

The preceding indications sometimes reveal the existence of batteries under cover. Particularly the blast of the guns makes an erosion along the edge of the wood or strips the trees on the inside of the wood, all of which is visible on photographs 13 and 14 (region of Arras).

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